

F10 Passive Safety Systems



BMW Service

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General information

Symbols used

The following symbol / sign is used in this document to facilitate better comprehension and to draw attention to particularly important information:



Contains important safety guidance and information that is necessary for proper system functioning and which it is imperative to follow.

Information status and national-market versions

The BMW Group produces vehicles to meet the very highest standards of safety and quality. Changes in terms of environmental protection, customer benefits and design make it necessary to develop systems and components on a continuous basis. Consequently, this may result in differences between the content of this document and the vehicles available in the training course.

As a general principle, this document describes left-hand drive vehicles in the European version. Some controls or components are arranged differently in right-hand drive vehicles than those shown on the graphics in this document. Further discrepancies may arise from market-specific or country-specific equipment specifications.

Additional sources of information

Further information on the individual topics can be found in the following:

- in the Owner's Handbook
- in the integrated service technical application

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The information in the document is part of the BMW Group technical training course and is intended for its trainers and participants. Refer to the latest relevant BMW Group information systems for any changes/supplements to the technical data.

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F10 Passive Safety Systems

1. Introduction

1.1. Passive safety system

The passive safety system of the F10 builds on the objectives and characteristics of the F01. The passive safety system fulfils all legislative requirements worldwide.

Extensive measures were taken on the body and on the occupants safety and protection systems. The passive safety system includes, in addition to the restraint systems, a special body structure which offers a excellent crash performance. In the event of an accident, the forces are reduced in a defined manner and therefore have less impact on the occupants.

The restraint systems ensure that the risk of injury is significantly reduced.

The 3rd generation of the Advanced Crash Safety Module ACSM is used on the F10 as the central airbag control unit for the passive safety system. It differs from the previous crash safety modules in that it has an external sensor system.



TE09-2334

F10 Passive safety systems

F10 Passive Safety Systems

2. Models

2.1. Overview

The passive safety system installed in the F10 is the third-generation Crash Safety Module. The following illustration provides an overview of the installed versions for the various models:

Model series	Model	Used as of	Design
E60	5 Series Saloon	09/2005	ACSM 1
E61	5 Series Touring	09/2005	ACSM 1
E63	6 Series Coupe	09/2005	ACSM 1
E64	6 Series Convertible	09/2005	ACSM 1
E85	Z4 Roadster	01/2006	ACSM 1
E86	Z4 Coupe	05/2006	ACSM 1
E88	1 Series Convertible	04/2008	ACSM 2
E70	X5 SAV	11/2006	ACSM 2
E71	X6 SAC	04/2008	ACSM 2
E93	3 Series Convertible	03/2007	ACSM 2
F01	7 Series Saloon	11/2008	ACSM 3
F02	7 Series Saloon long version	11/2008	ACSM 3
F07	5 Series Gran Turismo	10/2009	ACSM 3
F10	5 Series Saloon	03/2010	ACSM 3

F10 Passive Safety Systems

3. System Overview

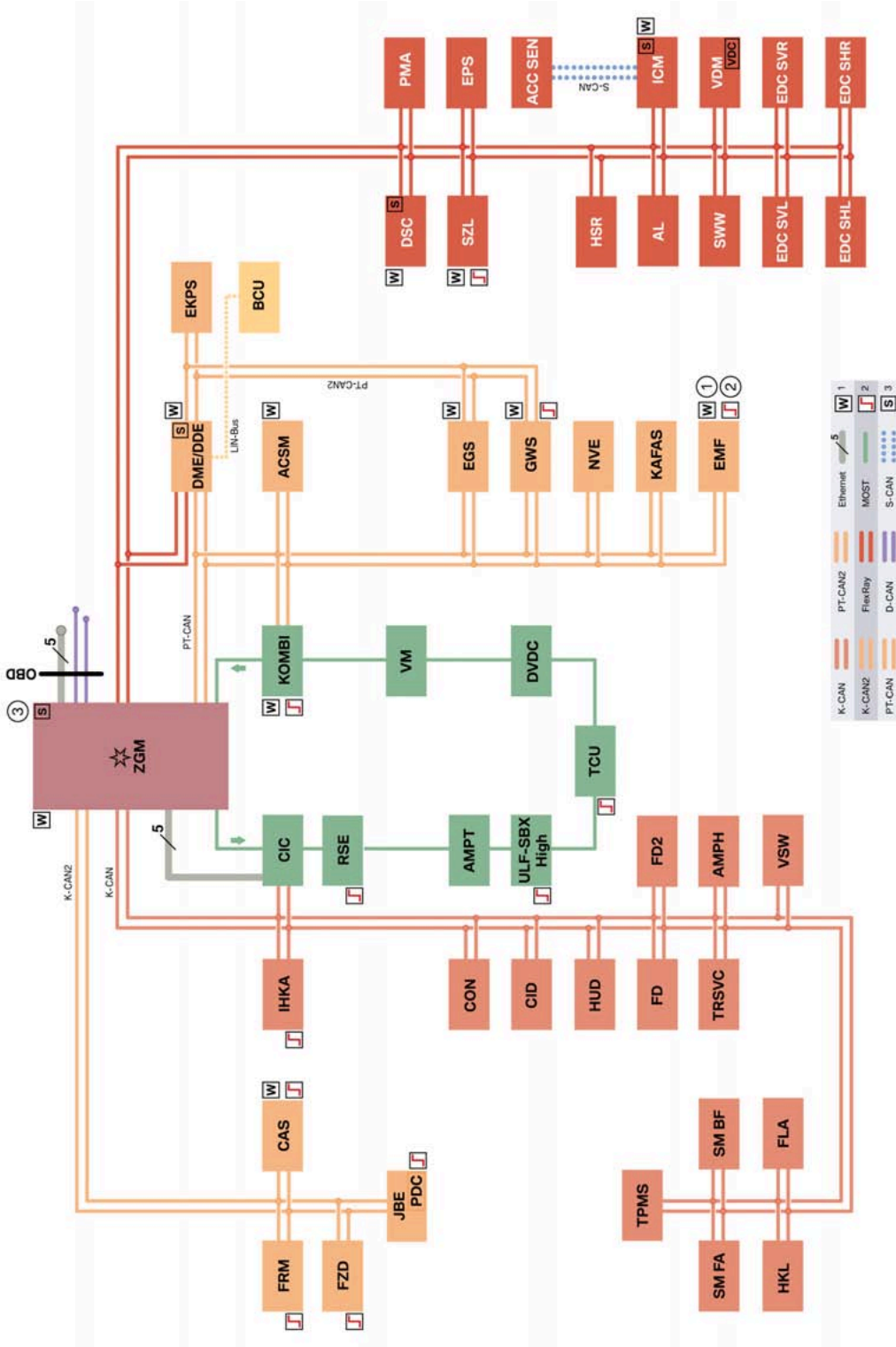
3.1. System wiring diagrams

The following bus overview provides you with an overview of the F10 vehicle electrical system/network structure and the integration of the modules into the PT-CAN.

F10 Passive Safety Systems

3. System Overview

3.1.1. Bus diagram



F10 Bus overview

F10 Passive Safety Systems

3. System Overview

Index	Explanation
1	Wakeable control units
2	Control units authorized to wake up the vehicle
3	Startup node control units, for starting up and synchronizing the FlexRay bus system
ACC-SEN	Active Cruise Control Sensor
ACSM	Advanced Crash Safety Module
AL	Active steering
AMPH	Amplifier High (high fidelity amplifier)
AMPT	Amplifier Top (top high fidelity amplifier)
BSD	Bit-serial data interface
BCU	Battery Charge Unit (for auxiliary battery)
CAS	Car Access System
CIC	Car Information Computer
CIC Basic	Car Information Computer Basic
CID	Central Information Display
CON	Controller
D-CAN	Diagnosis on Controller Area Network
DDE	Digital Diesel Electronics (Not for US)
DME	Digital Motor Electronics
DSC	Dynamic Stability Control
DVD	DVD changer
EDC SHL	Electronic Damper Control, rear left satellite unit
EDC SHR	Electronic Damper Control, rear right satellite unit
EDC SVL	Electronic Damper Control, front left satellite unit
EDC SVR	Electronic Damper Control, front right satellite unit
EGS	Electronic transmission control
EKPS	Electronic fuel pump control
EMF	Electromechanical parking brake
EPS	Electronic Power Steering
Ethernet	Cabled data network technology for local data networks
FD	Rear display
FD2	Rear display 2
FLA	High-beam assistant
FlexRay	Fast, preset and fault-tolerant bus system for use in automotive applications
FRM	Footwell module

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3. System Overview

Index	Explanation
FZD	Roof function center
GWS	Gear selector switch
HKL	Luggage compartment lid lift
HSR	Rear suspension slip angle control
HUD	Head-Up Display
ICM	Integrated Chassis Management
IHKA	Integrated automatic heating / air conditioning
JBE	Junction box electronics
KAFAS	Camera-based driver assistance system
K-Bus	Body bus
K-CAN.	Body controller area network
K-CAN2	Body controller area network 2 (500 kBit/s)
KOMBI	Instrument cluster
LIN-Bus	Local Interconnect Network bus
Local-CAN	Local Controller Area Network
MOST	Media Oriented System Transport
MOST port	Media Oriented System Transport port
NVE	Night Vision electronics
PDC	Park Distance Control
PMA	Parking Maneuvering Assistant Control Unit
PT-CAN	Powertrain CAN
PT-CAN2	Powertrain controller area network 2
OBD	Diagnosis socket
RSE	Rear seat entertainment system
SDARS	Satellite tuner
SMBF	Front passenger seat module
SMFA	Seat module, driver
SWW	Blind Spot Detection
SZL	Steering column switch cluster
TCU	Telematics Control Unit
TPMS	Tire Pressure Monitoring System
TR SVC	Control unit for reversing camera and side view
ULF-SBX	Universal interface box

F10 Passive Safety Systems

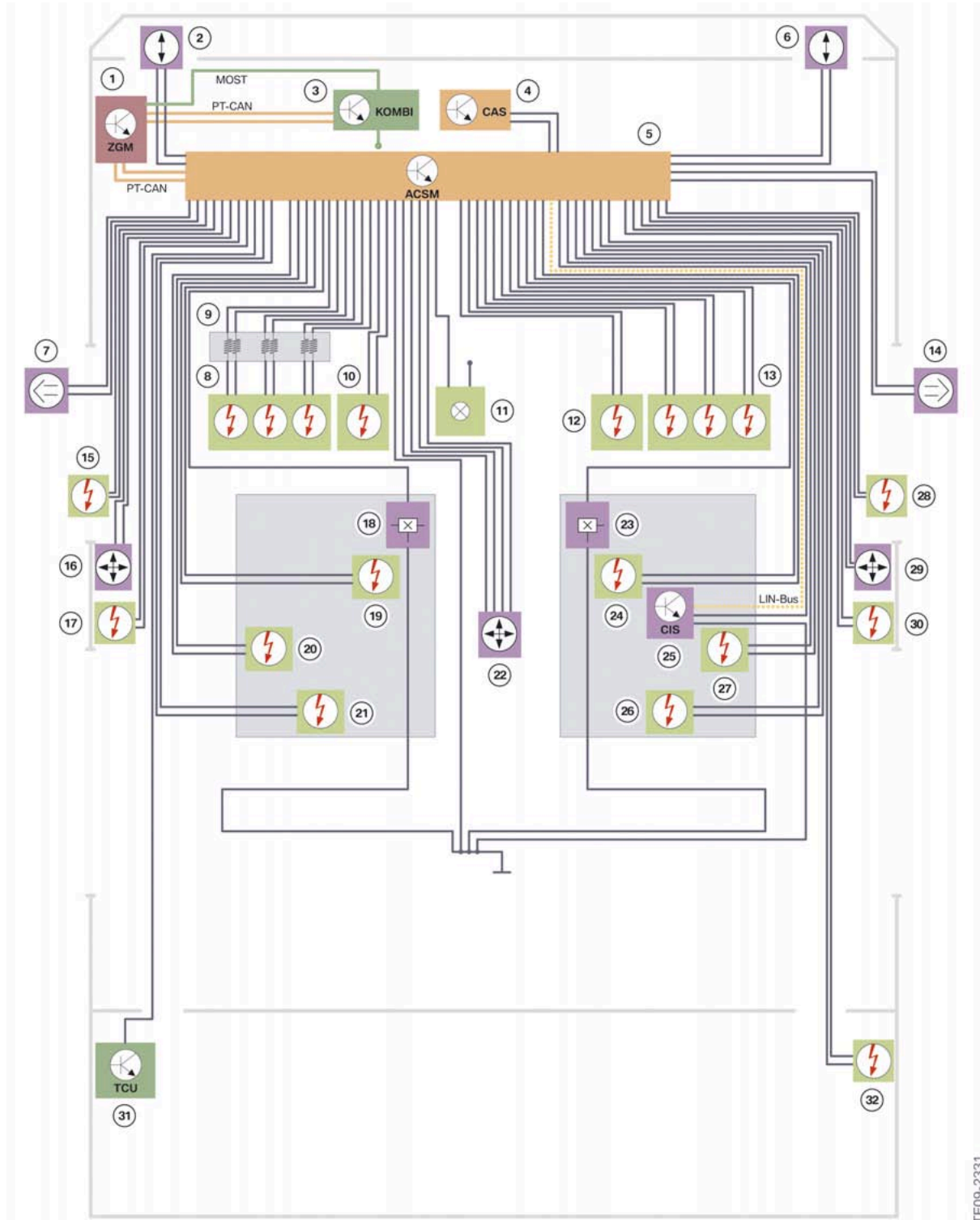
3. System Overview

Index	Explanation
VDM	Vertical Dynamics Management
VM	Video Module
VSW	Video switch
ZGM	Central Gateway Module

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3. System Overview

3.1.2. System wiring diagram



F10 System wiring diagram

TE09-2331

F10 Passive Safety Systems

3. System Overview

Index	Explanation
1	Central Gateway Module
2	Acceleration sensor, left engine support
3	Instrument cluster
4	Car Access System
5	Crash Safety Module
6	Acceleration sensor, right engine support
7	Door airbag sensor, front left (pressure)
8	Driver's airbag, two-stage with ventilation
9	Clock spring
10	Knee airbag, driver
11	Indicator lamp for front passenger airbag deactivation
12	Knee airbag, passenger
13	Front passenger airbag, two-stage with ventilation
14	Door airbag sensor, front right (pressure)
15	Head airbag, left
16	Acceleration sensor, B-pillar left
17	Automatic reel with adaptive force limiter, driver's side
18	Seat belt buckle contact, driver's seat
19	Seat belt pretensioner, driver
20	Side airbag, driver's side
21	Active head restraint, driver
22	Central sensor
23	Seat belt buckle contact, front passenger side
24	Seat belt pretensioner, front passenger
25	Seat-occupancy mat, CIS mat
26	Active head restraint, passenger
27	Side airbag, passenger side
28	Head air bag, right
29	Acceleration sensor, B-pillar right
30	Automatic reel with adaptive force limiter, front passenger's side
31	Telematics Control Unit for emergency call
32	Safety battery terminal

F10 Passive Safety Systems

4. Functions

4.1. Functions of the crash safety module

The main function of the Crash Safety Module is to constantly evaluate all sensor signals in order to detect a crash situation. As a result of the sensor signals and their evaluation, the crash safety module identifies the direction of the crash and the severity of the impact.

Also included is information on seat occupancy and whether or not the driver and/or front passenger have their seat belts fastened. From this information, measures are taken to selectively trigger the necessary restraint systems.

The crash safety module monitors the system itself and indicates that the system is ready for operation when the airbag indicator light goes out.

In the event of a fault during operation, this is stored in a fault memory, which can be read out for diagnostic purposes.

If a crash situation is detected, this is communicated to the other users in the bus-system network by a crash message. The relevant control units respond to this signal by executing their own functions according to the severity of the crash.

These functions include:

- Opening the central-locking system
- Activating the hazard warning flashers
- Switching on the interior light
- Deactivating the electric fuel pump
- Switching off the auxiliary heating
- Automatic emergency call.

Another function of the Crash Safety Module is the acoustic seat belt warning, which uses visual and audible signals to remind the driver and front passenger to fasten their seat belts.

The functions of the Crash Safety Module are divided into the following areas:

- Crash-relevant functions
- System monitoring functions
- Additional convenience functions.

4.2. Crash-relevant functions

The Crash Safety Module must fulfill the following crash-relevant functions:

- Evaluating the sensor signals
- Detecting crashes
- Determining the triggering time and the triggering sequence
- Triggering the output stages of the firing circuits

F10 Passive Safety Systems

4. Functions

- Sending the crash message to all bus users
- Crash documentation
- Emergency call function

4.2.1. Evaluating the sensor signals

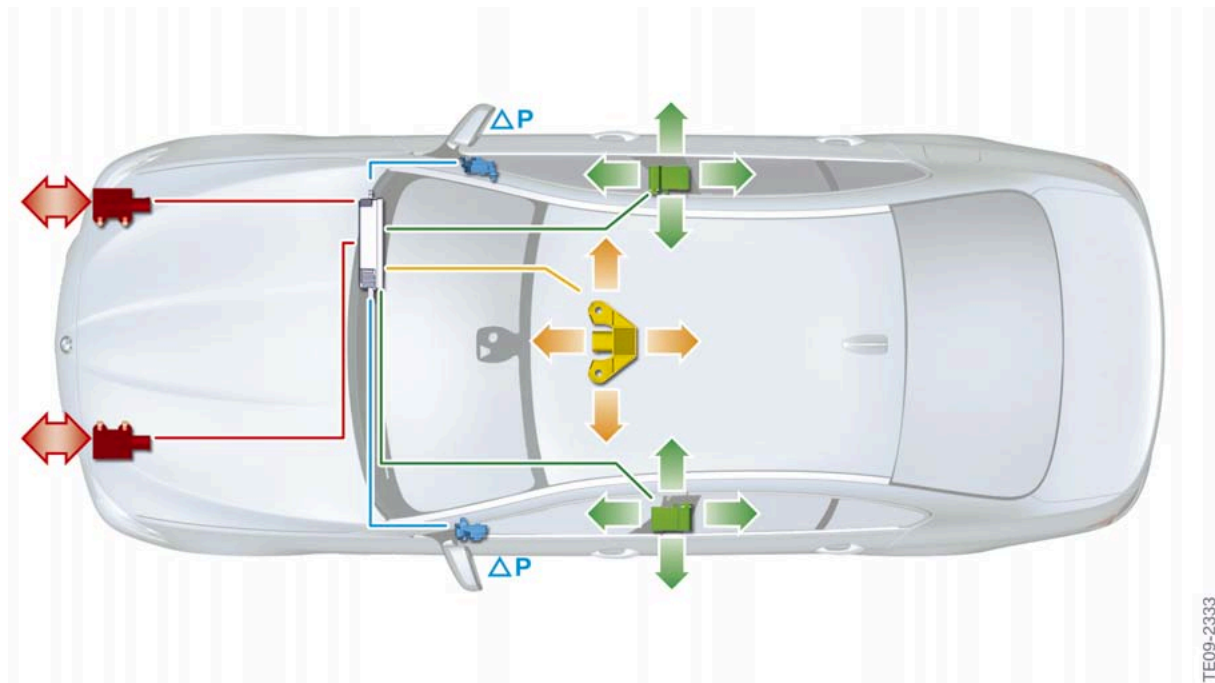
The sensors serve to detect and verify front-end, side-on and rear-end crashes. In addition, the system is also equipped with rollover detection.

The sensors are directly connected to the crash safety module, where its signals are evaluated and processed.

4.2.2. Detecting crashes

European version vehicles are equipped with the following sensors:

- One transverse and longitudinal acceleration sensor in the central sensor (yellow)
- One transverse and longitudinal acceleration sensor in each of the B-pillars (green)
- One airbag sensor for pressure in each of the front doors (blue).
- One longitudinal acceleration sensor on each of the engine supports (red)



F10 ACSM Sensors

The longitudinal acceleration sensors can measure both positive and negative acceleration. Using these signals, a front-end or rear-end crash is detected.

A side-on crash is detected using the lateral acceleration sensors and airbag sensors in the doors.

TE09-2333

F10 Passive Safety Systems

4. Functions

A crash in which the force-transfer direction is not perpendicular to the vehicle's longitudinal or transverse axis is detected by means of a combined transverse and longitudinal acceleration.

The longitudinal acceleration sensors on the engine supports serve to detect a front-end crash and its severity.

4.2.3. Triggering time and triggering sequence

The Crash Safety Module uses the values transmitted by the sensors to determine the direction and severity of the crash.

In the case of a front-end crash, for example, correspondingly high acceleration values must be detected by the longitudinal acceleration sensor in the B-pillar and by the longitudinal acceleration sensor in the central sensor. Based on the acceleration forces, an algorithm detects the severity and direction of the crash. Using this information, the triggering times and the sequence of the restraint systems to be activated is calculated.

A possible imminent rollover is also detected and the appropriate protection systems are activated.

4.2.4. Triggering the output stages of the firing circuits

The Crash Safety Module is powered by the Car Access System 4 (CAS 4) through terminal 30B. At terminal 30B, the Crash Safety Module is in offline mode. This means that it is active on the data bus and can fulfill all diagnostic functions. The triggering of the ignition circuits is blocked and only possible from terminal 15, on completion of the system self-test. Likewise, the Crash Safety Module is ready for ignition, even if in terminal R the engine turns OFF.

The ignition capacitors are charged via a switching controller. These capacitors make the firing energy available in the event of a crash. If the voltage supply is interrupted during a crash, the firing capacitors serve briefly as an energy reserve.

The output stages of the firing circuits consist of a high-side and a low-side power circuit-breaker. The high-side power circuit-breaker controls the firing voltage, while the low-side power circuit-breaker switches to ground. The output stages of the firing circuits are controlled by a microprocessor.

The high-side and low-side power circuit-breakers also serve the purpose of checking the firing circuits during the system self-test.

4.2.5. Sending the crash message

In the event of a collision involving triggering of the restraint systems, the Crash Safety Module sends a crash message to the users in the bus-system network. Parallel to this, the TCU is informed via a direct single-wire connection to transmit an emergency call.

Then, the respective control units perform the following functions depending on the crash severity:

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4. Functions

Function	Control unit
Switch off electric fuel pump	Digital Motor Electronics (DME) Via electronic fuel pump control (EKPS)
Switch off the auxiliary heating	Integrated automatic heating and air conditioning (IHKA) (Not for US)
Release central locking	Junction box electronics (JBE)
Switch on hazard warning flashers	Footwell module (FRM)
Switch on interior lights	Footwell module (FRM)
Transmit emergency call (only when airbag triggered)	Telematics Control Unit (TCU)

4.2.6. Crash entries

In the event of a collision where one or more actuators are triggered, a crash entry is stored in a non-erasable memory. After three crash entries, a non-erasable fault memory entry is stored with the instruction to replace the Crash Safety Module.



Note: The three crash entries can also be stored during the course of an accident. Each crash entry is assigned a system time.

The electronic control unit remains capable of firing even after three crash entries. The crash entries cannot be erased and are used to diagnose the device. A maximum of three crash entries can be stored. The control unit must then be replaced.

4.2.7. Emergency call function

The emergency call functions are country-dependent and are available to customers in countries with BMW Assist infrastructure. This means an appropriate service provider with a call center must be available. Another precondition for being able to make an emergency call is the availability of a telephone network.

With BMW ASSIST, the customer has a manual and an automatic emergency call as well as other functions.

A manual and an automatic emergency call function is provided as standard. Furthermore, the driver has the option of activating a breakdown call. Irrespective of whether the customer orders a telephone or not, each vehicle is equipped with a telematics control unit TCU, a telephone antenna, an emergency antenna, a handsfree kit and a GPS antenna for determining position.

Manual emergency call

The manual emergency call is intended for customers to request help quickly if they are present when an accident occurs without being involved themselves.

The emergency-call button is located in the roof function Center. The emergency call button is connected directly to the TCU.

F10 Passive Safety Systems

4. Functions

Pressing the emergency-call buttons establishes a voice connection with the relevant country provider. The voice connection is indicated by a flashing LED in the switch.

Automatic emergency call

The crash safety module sends a crash telegram to the TCU in the event of an accident of corresponding crash severity. The TCU places an emergency call, which at the same time contains the location of the vehicle.

Parallel to this, attempts are made to set up a voice connection with the vehicle occupants to obtain more information on the accident (severity of the accident, number of injured) so that further rescue operations can be initiated.

Extended automatic emergency call

Vehicles with BMW Assist have an additional function, the extended automatic emergency call (Advanced Automatic Crash Notification).

Using various sensor data of the extended automatic emergency call system, the risk of injury is determined and transmitted to the emergency coordination center.

The emergency call includes additional specific information about the accident. Thus the call center has more accurate information about the accident and the risk of injury, which can be passed on to the emergency coordination center. The emergency coordination center can then initiate the appropriate actions.

4.3. System monitoring functions

The Crash Safety Module has the following system monitoring functions:

- System self-test (pre-drive check)
- Indication of system operability
- Cyclic monitoring
- Fault indication and fault code storage
- Fault output (diagnosis)
- Acoustic and visual seat belt warning
- Deactivation of the front passenger front airbag, the knee airbag and side airbag in via the seat-occupancy detector.

4.3.1. System self-test

The Crash Safety Module performs a system self-test as of terminal 15. The airbag indicator light is activated for approximately five seconds during the system self-test.

When the system self-test is concluded and no fault has been found, the airbag indicator light goes out and the system is ready for operation.

F10 Passive Safety Systems

4. Functions

4.3.2. Indication of system operability

Crash Safety Module system operability is indicated by the airbag indicator light going out in the instrument panel.

4.3.3. Cyclic monitoring

Once the system self-test has been successfully concluded and the system is ready for operation, a cyclic monitoring procedure is performed for fault monitoring purposes. Cyclic monitoring serves the purpose of internal diagnosis of the electronic control unit and the overall airbag system. The cyclic monitoring is carried out continuously as of terminal 15 and it is also continued after reaching logical terminal R and after the engine is OFF.

4.3.4. Fault indication and fault code storage

The Crash Safety Module has a non-volatile fault memory. A fault entry is signalled by the airbag indicator light illuminating.

A distinction is made between internal and external faults when entering the fault code. Events such as triggering of an airbag or seat belt pretensioner are also stored in the fault memory.



Note: The entry of a triggered restraint system in the fault memory does not mean that the restraint system was defective in the crash situation, rather it only means that the ignited restraint system is not available for further triggering.

4.3.5. Fault output (diagnosis)

With the aid of the BMW diagnosis system, Integrated Service Technical Application (ISTA), the fault memory can be read out via the diagnostic interface. After rectifying the faults or after replacing the triggered components, the fault memory can be cleared with the diagnosis command "Clear fault memory".

4.3.6. Acoustic and visual seat belt warning

All vehicles with Crash Safety Module come standard with an acoustic and visual seat belt warning. The Crash Safety Module detects whether the driver and front passenger have fastened their seat belt. If not, a corresponding acoustic and visual indicator reminds them to fasten their seat belt. Both seat belt buckle switches are monitored separately.

For a description of the exact sequence of the acoustic and visual seat belt warning, refer to the information bulletin entitled "Passive safety system F01/F02".

F10 Passive Safety Systems

4. Functions

4.3.7. Deactivation of the airbags

Automatic deactivation of the airbag is provided in order to fulfill the requirements of the National Highway Traffic Safety Administration NHTSA. The child seats listed in the regulation (for an approximately one-year old child on the front passenger seat) must cause deactivation of the airbags.

To do so, a seat-occupancy mat is used to classify the occupant on the front passenger seat. As a further development of the Occupant Classification 3 mat (OC3 mat), the Capacitive Interior Sensing mat (CIS mat) is used in the F10.

The CIS mat consists of two elements: a sensor wire, which runs parallel to the seat heating in the seat cushion and an evaluation unit.

The CIS mat measures the capacitance and ohmic resistance between the sensor wire (anode) and the ground of the vehicle (cathode) at a frequency of 120 kHz. The change in capacitance and resistance enables the CIS mat to determine whether an adult or a child in a child seat is on the front passenger seat.



Measuring procedure of the CIS mat, example: F07

Deactivation of the front passenger airbag, side airbag and knee airbag on the front passenger side is signalled by the indicator lamp for front passenger airbag deactivation.

The indicator lamp for front passenger airbag deactivation in the roof function center is illuminated if a child restraint system tested according to the requirements of the NHTSA with a small child has been detected on the front passenger seat or the front passenger seat is unoccupied.

The brightness of this light is controlled by automatic regulation of the display lighting.

F10 Passive Safety Systems

5. System Components

5.1. Crash Safety Module

The Crash Safety Module is contained in a housing with three sockets.

Two sockets serve to connect the wiring harness. One other socket is provided for the cockpit wiring harness.



F10 Crash Safety Module

The Crash Safety Module is located in the cockpit module behind the glove box, as it was not possible to locate it centrally on the transmission tunnel due to the size of the Crash Safety Module and the wiring harness connection. Only the associated sensor system has remained on the transmission tunnel, close to the center of gravity.

The Crash Safety Module does not contain any sensors. These have been relocated to an additional central sensor on the transmission tunnel.

5.2. Sensors and switches

The following sensors and switches are installed:

- Central sensor for longitudinal and lateral acceleration
- Sensor for transverse and longitudinal acceleration at the B-pillars
- One airbag sensor in each of the front doors (pressure).
- One longitudinal acceleration sensor on each of the engine supports
- CIS mat
- Seat belt buckle switch
- Emergency call button

5.2.1. Central sensor

The central sensor on the transmission tunnel contain a transverse and a longitudinal acceleration sensor.

F10 Passive Safety Systems

5. System Components



TE08-1052

F10 Central sensor

5.2.2. B-pillar transverse and longitudinal acceleration sensor

The transverse and longitudinal acceleration sensors in the B-pillars serve to detect head-on, side-on and rear-end crashes.

The left and right sensors are identical in design.



TE08-1099

F10 B-pillar transverse and longitudinal acceleration sensor

5.2.3. Door airbag sensor, front (pressure)

The airbag sensors in the front doors are used for side impact detection. In addition to the high transverse acceleration values, the pressure in the cavity of the door increases in the event of a side-on crash.

The airbag sensors are located on the inner door panel of the front doors.

F10 Passive Safety Systems

5. System Components



F10 Door airbag sensor, front (pressure)

TE08-1055

5.2.4. Longitudinal acceleration sensor

Two longitudinal acceleration sensors are installed in the front area of the engine supports. The measured values are transmitted to the Crash Safety Module and evaluated there.



F10 Engine support longitudinal acceleration sensor

TE08-1056

5.2.5. CIS mat

A Capacitive Interior Sensing mat (CIS mat) is installed in the front passenger seat for seat-occupancy detection. This replaces the OC3 mat, which was previously installed for this function. The CIS mat detects whether an adult or a child in a child seat is in the front passenger seat. Deactivation of the front passenger airbag, side airbag and knee airbag is signalled by the illumination of the indicator lamp for front passenger airbag deactivation in the roof function center.

The CIS mat consists of two elements, a sensor wire, which runs parallel to the seat heating in the seat cushion, and an evaluation unit. The CIS mat measures the capacity and the ohmic resistance between the sensor wire (anode) and the ground of the vehicle (katode) at a frequency of 120 kHz. The CIS mat uses changes in the capacity and the resistance to determine whether an adult or a child is in the front passenger seat.

F10 Passive Safety Systems

5. System Components

5.2.6. Seat belt buckle switch

The seat belt buckle switches are located in the seat belt buckles of the driver's and front passenger's seat.

The seat belt buckle switch detects whether the seat belt buckle tongue is in the seat belt buckle. The supply of power to the sensor and the evaluation are carried out by the Crash Safety Module.

From terminal 15, the seat belt buckle switch is monitored continuously. The signal is used for the visual and acoustic seat belt warning and for determining which restraint systems are to be triggered.



TE08-1294

F10 Seat belt buckle switch

5.2.7. Emergency call button

The emergency-call button is located in the roof function center.



TE09-1248

F10 Roof function center with emergency call button

F10 Passive Safety Systems

5. System Components

5.3. Actuators

The following actuators are installed in the F10:

- Driver's airbag
- Front-passenger airbag
- Knee airbag, left and right
- Head airbag, left and right
- Side airbag, front left and right
- Belt tensioner, front left and right
- Active head restraints, front left and right
- Safety battery terminal.

In addition, the following indicator lights inform the occupants of the status of the safety systems:

- Airbag indicator light
- Seat belt warning light
- Indicator lamp for front passenger airbag deactivation

The following two graphics show the airbags in non-triggered and triggered status. Depending on the type of the specific crash, only certain airbags are triggered.



F10 Triggered airbags

TE09-2335

F10 Passive Safety Systems

5. System Components

5.3.1. Adaptive Driver's airbag

The task of the driver's airbag is to decrease the risk of injury for the driver in the event of a head-on crash. The driver's airbag is located in the impact plate on the steering wheel. The driver's airbag is equipped with a gas generator.



TE08-1100

F10 Steering wheel with driver's airbag

An active vent valve and a two-stage generator are installed which, depending on the detected crash severity, the stages can be triggered with different timing.



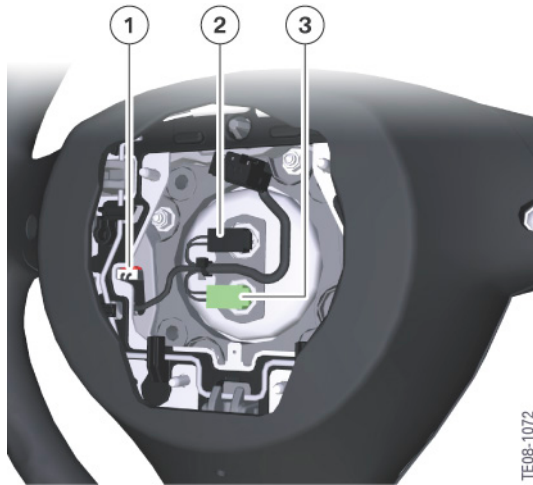
TE08-1071

F10 Adaptive Driver's airbag steering wheel with the airbag removed.

F10 Passive Safety Systems

5. System Components

Index	Explanation
1	Gas generator with exhaust vents
2	Actuator for vent valve



F10 Adaptive Driver's airbag, rear view.

Index	Explanation
1	Connection of the squib for the active vent valve
2	Connection of the ignition squib for the first stage of the driver's airbag
3	Connection of the ignition squib for the second stage of the driver's airbag

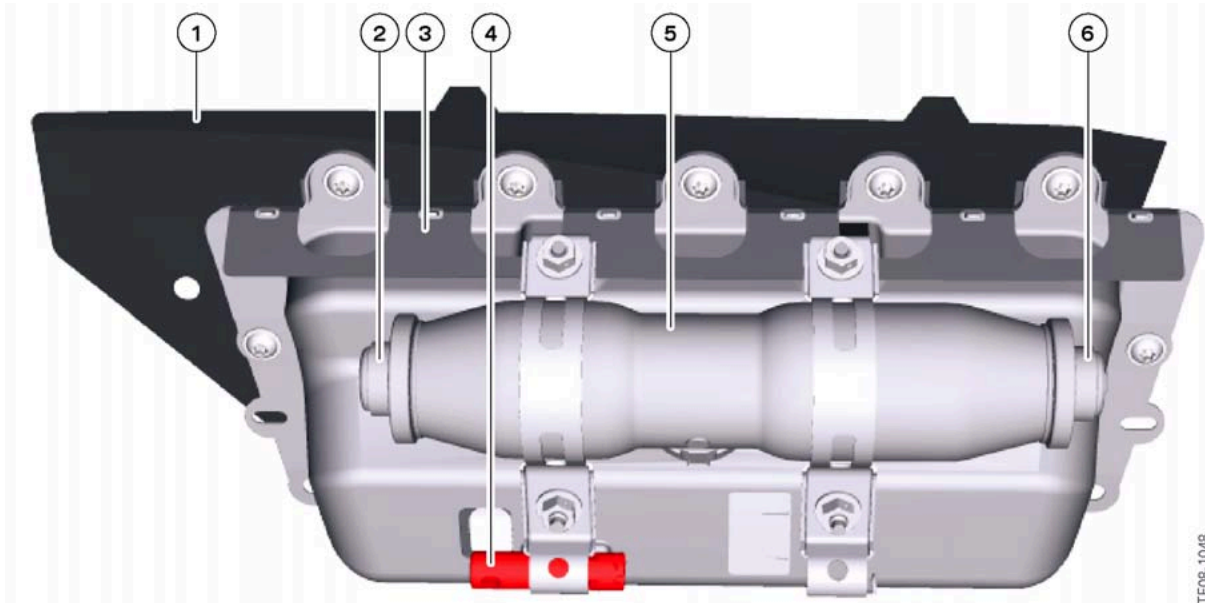
Note: The Active driver's and passenger's airbags are equipped with an active vent valves.

5.3.2. Adaptive Front passenger airbag

The task of the front passenger airbag is to reduce the risk of injury to the passenger in the event of a head-on collision. The front passenger airbag is located in the dashboard. When the front passenger airbag unfolds, the dashboard is broken open at pre-defined locations. The front passenger airbag opens in the direction of the windshield, exits towards the top and rests against the windshield and the dashboard. The front passenger airbag is equipped with a two stage generator which, depending on the detected crash severity, the stages can be triggered with a time difference.

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5. System Components



F10 Active Front passenger airbag

Index	Explanation
1	Cover
2	First stage squib
3	Airbag housing
4	Actuator for the active vent valve
5	Inflator assembly
6	Second stage ignition squib

Note: The Active driver's and passenger's airbags are equipped with an active vent valves.

5.3.3. Knee airbag

The US legal requirements call for the passive restraint (without seat belt) of the occupants. Therefore, to control the occupant forward displacement in the event of a head-on collision, knee airbags are installed on the driver's side and front passenger side.

F10 Passive Safety Systems

5. System Components



F10 Knee airbag

TE08-1058

5.3.4. Head airbag

As additional protection of the occupants' head, the F10, uses curtain (head) airbags.

The curtain airbag extends from the A-pillar to the C-pillar and covers the entire area of the side windows. It unfolds between the occupants and the side structure.

System features:

- Extended covered area across all front windows, front and rear
- Reduction of risk of injury to occupants by glass splinters
- Covered area epitomized for occupants of different sizes

5.3.5. Side airbag, front

As in the F01, the front side airbags are triggered from the front seat backrests.

The side airbags and the gas generators are located in a plastic housing referred to as the airbag module. This is built into the front seat backrest and is covered by the rear panel.

In the event of activation, the side airbag emerges between the backrest frame and backrest rear panel as it unfolds between the side structure and occupant.



Note: It is important that no additional seat covers are installed as they would greatly impair the airbag function or even defeat it entirely.

F10 Passive Safety Systems

5. System Components



TE07-1935

F10 Seat with side airbag

Index	Explanation
1	Side airbag

5.3.6. Front seat belt tensioner

In the F10, the familiar three-point seat belt is the belt system used on the front seats.



TE09-1265

F10 Seat belt

F10 Passive Safety Systems

5. System Components

Index	Explanation
1	Seat belt tensioners
2	Side airbag
3	Automatic reel with adaptive force limiter

Seat belt tensioners

The task of the pyrotechnic belt tensioner is to minimize the seat belt slack in the pelvis and shoulder areas in the event of an impact, thereby improving the restraining action.

The belt tensioners are located on the driver's seat and front passenger seat. The belt tensioners are ignited in certain crash situations.

The seat belt buckle is connected by means of a steel cable to the piston in the tensioning tube. If the squib is triggered, gas pressure is created, which moves the piston in the tensioning tube. At this, the seat belt buckle is pulled down by the cable and the seat belt is tensioned.



F10 Belt tensioner

Index	Explanation
1	Seat belt buckle switch
2	Connection for ignition squib
3	Tensioning tube with piston

Automatic reel with adaptive force limiter

For the driver and front passenger, an automatic reel is installed as on F01/F02.

With the aid of a gas generator, there is a changeover from a high to a low power level during the impact, in order to reduce the belt restraining forces.

F10 Passive Safety Systems

5. System Components

With optimal tuning in connection with the airbags, the kinetic energy of the occupant is more uniformly reduced over the duration of the impact. Thus lower occupant stress values are achieved.

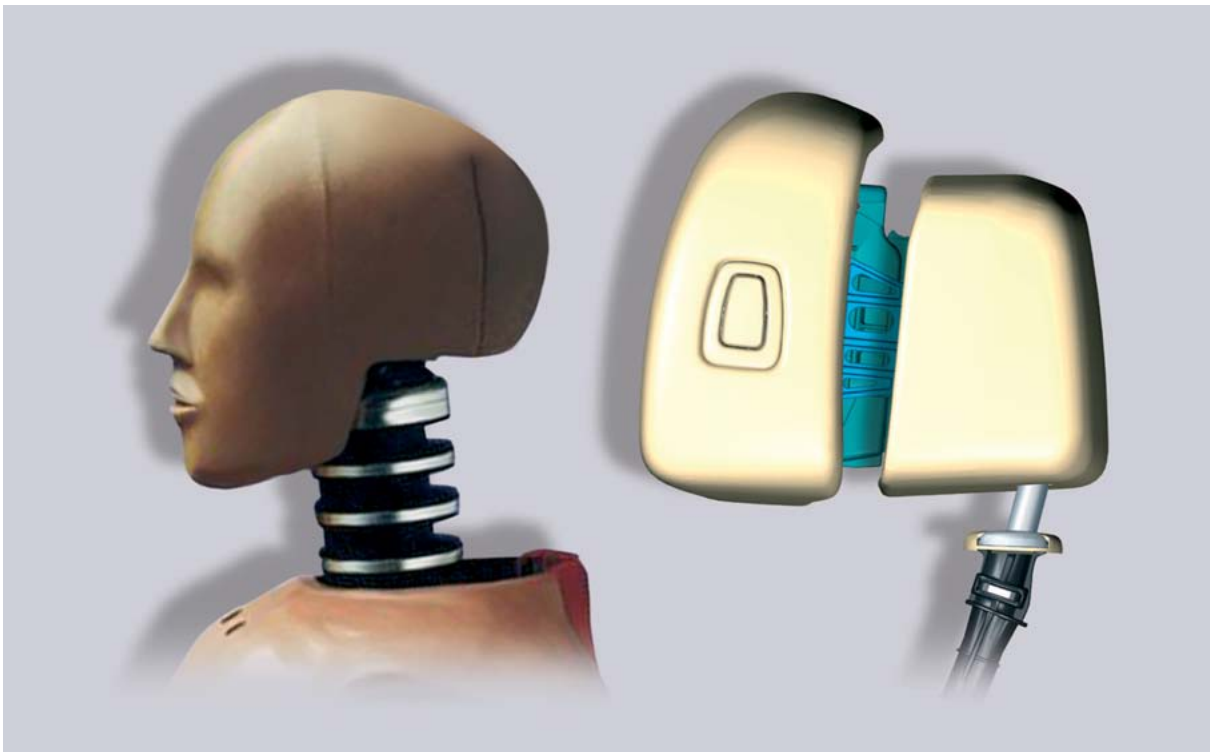
The operating principle of the adaptive force limiters in the F10 are the same as on the F01.

5.3.7. Active head restraints, front

For the F10, there are two versions depending on the installed seat. Both have a head restraint with pyrotechnic actuator which, in the event of a rear-end collision with sufficient severity, optimizes the distance and the height relative to the head. This reduces the load in the cervical spine area in the event of a rear-end collision. The headrest is activated at an early stage, even before the backward displacement of the occupant's head.

In order to offer as much convenience as possible, the front section of the manually adjustable head restraints can be pulled forward or pushed backward approximately 30 mm. It is a two-stage adjustment. This allows for three different positions for the head restraint depth adjustment.

On the multi-function seat, the headrest is adjusted by means of the headrest adjustment.



F10 Manually adjustable head restraint

The active head restraint minimizes the load in the cervical spine area in the event of a rear-end collision. For the occupants in the vehicle, the correct adjustment of the head restraints and the distance of the head from the head restraint are of crucial importance.

In the event of a rear-end collision, the active head restraint reduces the distance between the head and the head restraint before the occupants are displaced backwards. This reduces the risk of injury to the cervical vertebrae, even in the event of a small accident.

F10 Passive Safety Systems

5. System Components



Note: If the active head restraints have been triggered, the pyrotechnic actuators must be replaced in the workshop. It is essential to refer to the repair instructions.

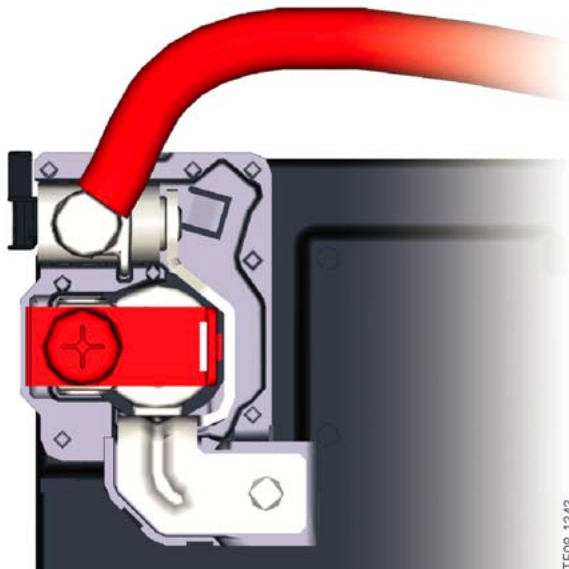


Note: Never use any seat or head restraint covers on the head rest that can impair the protective effect.

5.3.8. Safety battery terminal

The safety battery terminal is triggered at different thresholds when the Crash Safety Module detects a head-on, side-on or rear-end crash of sufficient severity. The connecting cable between the battery and starter/alternator and positive battery connection point is then disconnected pyrotechnically. The safety battery terminal is located directly at the positive terminal of the battery.

Despite the safety battery terminal being blown off, it is guaranteed that all consumers relevant to safety such as hazard warning flashers, interior lighting and telephone will continue to be supplied with voltage.



F10 Safety battery terminal

5.3.9. Airbag indicator light

The airbag indicator light is located in the instrument cluster. Crash Safety Module system operability is indicated by the airbag indicator light lighting up and then going out during the pre-drive check. The airbag indicator light is controlled by means of a message on the PT-CAN from the Crash Safety Module. The instrument panel receives a message on a cyclical basis. If the message fails to arrive, the airbag indicator light is activated.

F10 Passive Safety Systems

5. System Components



F10 Airbag indicator light

5.3.10. Seat belt warning light

A visual and audible warning is issued if the seat belt is not fastened or is unbuckled when the vehicle is in motion.



F10 Seat belt warning light

The status of the seat belt buckle contacts of the seat bench is briefly visible in the TFT display of the instrument panel when the vehicle starts or a contact changes.

5.3.11. Indicator lamp for front passenger airbag deactivation

In the F10, the indicator lamp for front passenger airbag deactivation is in the roof function center. The indicator lamp for front passenger airbag deactivation if the CIS mat detects a child seat with a child approximately one year old or if the front passenger seat is not occupied.

The brightness of the indicator lamp for front passenger airbag deactivation is controlled by the automatic brightness control of the display illumination.

F10 Passive Safety Systems

5. System Components



F10 Roof function center with indicator lamp for front passenger airbag deactivation



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